Chapter 14

PHYSIATRY: INTERDISCIPLINARY MANAGEMENT

KATHERINE M. FLOOD, MD*

*Program Leader, Physical Medicine and Rehabilitation Medicine Service, VA Pittsburgh Health Care System, Pittsburgh, PA 15240; Assistant Professor, Division of Rehabilitation Medicine, Department of Orthopedic Surgery, School of Medicine, University of Pittsburgh, PA 15213

INTRODUCTION

Advances in medical technology and in emergency health service healthcare delivery have brought about a multidisciplinary approach to patient treatment throughout medicine. The physician, whether in a hospital emergency department, his own office, or a battalion aid station, is surrounded by other healthcare practitioners and technicians who possess skills and knowledge that are essential for the optimum care of the patient. Even though multidisciplinary teams are common, a true interdisciplinary approach to healthcare delivery remains rare. An interdisciplinary approach requires the communication of observations and impressions, followed by the preparation of comprehensive goals and a treatment plan. The underlying difference between the multidisciplinary approach and the interdisciplinary approach is communication.

The common multidisciplinary approach may involve many practitioners who set independent treatment goals and make their own treatment plans. In the interdisciplinary approach, each practitioner does his own assessment and reports his findings, impressions, and recommendations to other professionals during the "team conference." Through the mechanism of the team conference, information is shared, common goals are established, and a consolidated treatment plan is formulated. This communication ideally leads to an outcome which will be greater than the sum of its individual parts.[1]

Although the emphasis of this chapter is on an interdisciplinary approach within the military healthcare system, permanently impaired soldiers may receive some or all of their rehabilitative care within the Veterans Affairs healthcare system or in civilian rehabilitation facilities.

HISTORICAL PERSPECTIVE

The response of military medicine to war injuries has played a key role in the development of rehabilitation medicine as a specialty and in the development of the individual disciplines whose practitioners make up the interdisciplinary rehabilitation team. Between 1890 and the onset of World War I, an area of specialization within medicine developed which was known as electrotherapy. Electrotherapists frequently aligned themselves with homeopathic physicians, hydrotherapists, and others who espoused the use of natural treatments, rather than the often detrimental purgatives and mercurials used by the allopathic physicians of the day. With time the venue of the electrotherapists (or electrotherapeutists, as they became known) expanded to include exercise, dietetics, psychotherapy, climatology, and phototherapy. The interest of electrotherapeutists in the use of physical modalities resulted in these physicians being referred to as "physical therapists" or "physiotherapeutists."[2]

At the same time, a subspecialty of surgery called orthopedics was evolving. The orthopedists distinguished themselves by the use of mechanical devices, such as braces, in the treatment of patients. In 1917, with America's entry into World War I, it became apparent that the U.S. Government would have to care for large numbers of battlefield casualties, and a war preparedness committee was organized. Joel Goldthwait, an orthopedist and director of the mechanical department at the Massachusetts General Hospital, urged his personal friend, General Pershing, to create a division of orthopedic surgery in the army. In August 1917, the new Division of Special Hospitals and Physical Reconstruction was created. This division included general surgery, orthopedic surgery, head surgery, and neuropsychiatry. Orthopedics was to be responsible for the construction of artificial limbs. Mary McMillan, who was then chief aide to Dr. Goldthwait, was given the responsibility for training "orthopedic aides." Under her direction, 800 women underwent 30-day training courses in "military massage." Later, this group would become the nucleus of physical therapy technicians, from which evolved the American Association of Physical Therapists.[2]

Also during 1917, Frank Granger was appointed head of the physiotherapy section of the Division of Special Hospitals. Dr. Granger was president of the American Association of Electrotherapy and Radiology at that time; thus, physiotherapeutic physicians became recognized in the area of physical reconstruction.

The discipline of occupational therapy originated (before either the physician physiotherapeutists or Mary McMillan's physical therapy technicians) as the "work cure and moral treatment" therapists of 19th century psychiatry. In 1918, the discipline of occupational therapy was added to the staff of the Division of Special Hospital and Physical Recon-

struction, completing the nucleus of the rehabilitation team as we know it today.[2]

In the years between World Wars I and II, the physiotherapeutists continued to promote the use of physical modalities and were instrumental in developing training programs and accreditation measures for both the occupational and physical therapists.[2]

Because the onset of World War II occurred at a time of advancing medical technology, greater numbers of war injured were saved than was previously possible. Dr. Howard Rusk was appointed head of the U.S. Air Force Convalescent Training Program, and is credited with developing modern rehabilitation medicine and, after the war, with founding its first institute. By 1946, the term "physiatrist" was coined to designate a physician specializing in physical medicine. In 1947, the Advisory Board for Medical Specialties and the American Medical Association established the American Board of Physical Medicine to be responsible for conferring certification in physiatry, and in 1949, the words "and Rehabilitation" were added to the Board's title.[2]

Examination of the historical development of physical medicine and rehabilitation makes it easy to see the roots of the interdisciplinary team. In a way, the core disciplines of physiatry, physical therapy, and occupational therapy "grew up together." It is unlikely that any of them could have developed alone. Other disciplines that are important members of the team, but whose history has not been specifically discussed, were evolving alongside the early electrotherapeutists and orthopedists. They will be addressed in the next section.

THE INTERDISCIPLINARY TEAM

The composition of a rehabilitation team varies depending on the characteristics of the patient's injuries and resulting impairments. The ultimate goal of the team is always the best possible functional outcome in the least possible time. In the case of simple injuries, such as an uncomplicated fracture, the team may consist of a physician and a physical therapist. The physician is responsible for making the diagnosis (a fracture) and applying a medical treatment (a cast). A treatment plan is formulated by the physician and therapist, and the therapist is responsible for training the patient in the treatment plan and its restrictions. The therapist is also responsible for identifying and remediating any concurrent disabilities (eg, decreased mobility, which requires training in crutch ambulation). More complex injuries or permanent impairment requires more team members.

Kinesiotherapist

Kinesiotherapy, previously called corrective therapy, is a discipline unique to the Veterans Health Service. During World War II, the shortage of physical therapists led to the recruitment of physical educators to provide exercise therapy for psychiatric patients. These individuals became known as corrective therapists. Recently, the discipline has adopted the title kinesiotherapist to emphasize its interest in functional movement.[3] Kinesiotherapists provide exercise programs to improve and maintain gross motor function; evaluate and train patients for adapted automobile driving; and promote fitness through exercise for acute, chronic, and convalescent patients.[1]

Occupational Therapist

As already described, occupational therapists were added to the corps of rehabilitation aides in 1918. Many presidents of the Occupational Therapy Association were physical therapy physicians, and training for occupational therapists progressed under their leadership. In 1932, the training was increased from 6 months to 9 months, and at present there is a general prerequisite for a baccalaureate degree and a certificate of occupational therapy training.[2]

The role of the occupational therapist on the rehabilitation team includes evaluation and training of the patient in activities of daily living (ADL), such as feeding, bathing, dressing, bathroom transfers and activities, homemaking, and child care skills. Occupational therapists evaluate and supervise activities aimed at improvement and maintenance of joint range-of-motion, muscle strength, endurance, and coordination of the upper extremities as relates to functional tasks. Occupational therapists also identify and remediate sensory and cognitive deficits. They evaluate the patient's home environment and recommend modifications and equipment that will maximize independent functioning. The occupational therapist educates and trains the patient and his family in adaptive techniques and potential for independence and helps the patient explore vocational skills and avocational interests. Often, occupational therapists are responsible for the fabrication of thermoplastic and plaster splints that are used to support and protect paretic limbs and prevent deformities. In some settings, occupational

therapists are involved in the evaluation of driving habits and skills and the evaluation and management of dysphagia. Overall, the emphasis of the occupational therapist is on the development of functional skills and abilities.[1]

Orthotist and Prosthetist

An orthotist is trained in the design and construction of a wide variety of braces (orthoses). A prosthetist is trained in the design and construction of artificial limbs (prostheses). To sit for the certificate examination in either of these professions, the candidate must have a baccalaureate degree and 1 year of apprenticeship. Professionals from both disciplines work as part of the rehabilitation team to provide the appropriate devices for maximizing patient function and minimizing secondary disability.

Physiatrist

A physiatrist is a physician who has completed specialty training in Physical Medicine and Rehabilitation. Currently, a Doctor of Medicine or Doctor of Osteopathy degree followed by 1 year of general internship training, 3 years of specialty training, and 1 year of independent practice is required to sit for the American Board of Physical Medicine and Rehabilitation.[4] In most rehabilitation settings, the physiatrist acts as the team leader. By virtue of his training, the physiatrist has a broad understanding of the expertise and roles of the other team members, as well as his own medical understanding of disease processes and effects. He has the ability to take all the team's information and synthesize a comprehensive clinical picture and plan. The physiatrist can also act as liaison to other physicians involved in the patient's care, but who may not understand the function of the interdisciplinary team.

Physical Therapist

Physical therapy training, like occupational therapy training, has progressed from McMillan's 30-day course for physical therapy technicians, to programs requiring a baccalaureate degree, a certificate in physical therapy, and a state licensing examination.[2] Physical therapists provide patient training and supervision in all forms of exercise programs (range-of-motion, resistive, endurance or aerobic, coordination) and mobility techniques (transfer from one position to another, ambulation with or without assistive devices, wheelchair mobility). Physical therapists are responsible for the administration of physical therapy modalities (heat, cold, hydrotherapy, massage, traction, electrical stimulation) and the assessment of adaptive equipment needs (crutches, canes, walkers, wheelchairs, and wheelchair cushions).[1]

Psychologist

The role of the psychologist is, perhaps, one of the most diverse on the rehabilitation team. In the case of a patient who has impairment of cognitive processes, the psychologist or neuropsychologist administers tests of intelligence, memory, and perceptual functioning to define the deficits and help the team plan treatment that will compensate for these deficits. Often, patients who appear to be functioning well have subtle cognitive deficits that will interfere with their participation in the rehabilitation program. The patient without cognitive deficits may benefit from psychological counseling regarding his adjustment to changes in his physical body and to his role within his family and community. The psychologist can be helpful to the patient's family in these same areas. Just as important, the psychologist may also act as counselor to the rehabilitation team by identifying nonproductive interactions between the team and the patient, between the team and the family, or between team members.

Recreational Therapist

Leisure functioning, or recreation, is easily recognized as a component of a rewarding lifestyle, and the need for recreation is not blunted or eliminated by physical impairment or disability. As with the other disciplines within the rehabilitation team, recreational therapy has evolved over the years and, at present, is best defined as the use of recreational services to bring about desired changes in behavior and promote the growth and development of the patient. Currently, undergraduate- and graduate-level training programs are accredited, and a voluntary certification examination is recognized by several state and local agencies as well as other private institutions and organizations.[5]

Rehabilitation Nurse

The rehabilitation nurse performs all usual nursing duties, but has the additional responsibility of promoting maximal function and independence of the patient. While rehabilitation nursing does not

necessitate the acquisition of new knowledge, skills, or attitudes, a greater depth of understanding is required in some areas. Specifically, the rehabilitation nurse must have a full understanding of the psychosocial effects of long-term illness; a strong knowledge of anatomy, physiology, and pathophysiology of the neuromuscular system; and an understanding of kinesiology (the science of body movement). In addition, the attitude and temperament of the rehabilitation nurse must differ in some ways from that of the acute care nurse. The rehabilitation nurse must deal with the chronicity of physical impairments, and with a role shift from caring and doing for the patient to assisting the patient to care for himself.[6] The rehabilitation nurse works with the patient outside the formality of the therapy departments and during the evening and early morning hours, and is in the best position to assess the patient's learning and the carry over of new skills and abilities.

Speech and Language Therapist

The responsibilities of the speech and language therapist (or speech therapist) include all aspects of communication. A speech therapist evaluates the patient's cognitive and language skills (the ability to comprehend as well as the ability to produce speech), including written and other nonverbal modes of communication. The speech therapist is an expert in the mechanical function of the oropharyngeal and laryngeal areas and will assess the patient's ability to chew and swallow, as well as to perform the mechanical activities involved in speech. When verbal communication is not possible, the speech therapist will educate the patient, family, and other caregivers in alternative forms of communication such as sign language or the use of adaptive devices (word and letter boards, electrolarynxes, speech synthesizers). Since communication and cognition are closely linked, the speech therapist is also involved in cognitive evaluation and retraining.

Social Worker

The social worker interacts with the patient, family, and team to gather information regarding the patient's living situation and resources, including financial status. The social worker has a working knowledge of programs and community support services that may be useful to the patient. In some institutions, the social worker also assumes the responsibility for patient and family counseling.

Vocational Rehabilitation Counselor

Vocational rehabilitation counseling developed in conjunction with rehabilitation medicine at the time of World War I. Over the years, educational requirements for this discipline have evolved to include civil service certification and a master's level degree in psychology, education, personnel administration, or rehabilitation counseling.[7]

The responsibility of the vocational rehabilitation counselor is to work with a physically handicapped or mentally impaired patient to establish a mutual understanding of capabilities and limitations through review of records, testing, and direct observation. With this information, the vocational rehabilitation counselor assists the patient in developing appropriate vocational plans and goals and in obtaining the necessary training to achieve these goals. The vocational rehabilitation counselor also acts as an advocate for the patient in the workplace.[7]

Patient and Family

The team, no matter how expert or dedicated, can merely direct and instruct the patient. Only the patient can perform the exercises, learn the techniques, and make the decision to adapt to his impairment. The team can advise and instruct the family regarding the patient's disabilities and capabilities, but, ultimately, it is the patient and his family who determine the success of the team's efforts.

THE INTERDISCIPLINARY TEAM AT WORK

To illustrate the function of an interdisciplinary rehabilitation team, several case studies, ranging from a simple long-bone fracture to the more complex case of traumatic brain injury are presented here.

Case Study 1: Distal Femur Fracture

A 22-year-old soldier sustained a distal femur fracture in a motor vehicle accident. He underwent immediate reduction and intramedullary rod placement, and the extremity was placed in a long-leg cast with the knee in full

extension. The patient was referred for rehabilitation medicine evaluation and management on the first postoperative day. The orthopedic surgeon indicated that the patient was to be non–weight-bearing on the fractured right leg for 6 weeks.

The physiatrist's evaluation revealed that in addition to the current injury, the patient had an injury to the left hand that had occurred while playing high school football. The left hand still caused the patient discomfort, especially when doing pushups. On physical examination it was noted that the patient had tenderness to palpation over the scaphoid bone of the left hand. The physiatrist ordered a radiograph of the left hand and wrist.

The patient was referred to physical therapy for strengthening of the bilateral upper extremities; left lower extremity; and right hip flexor, including extensor and abductor progressive resistive exercises and isometric exercise of the right quadriceps, hamstring and ankle plantar and dorsiflexor muscle groups. The physical therapist began training the patient in bed mobility and transfers while avoiding weight bearing on the right lower extremity. Training in crutch ambulation was delayed pending the left hand radiographs. The patient went to occupational therapy for assessment of self-care skills (bathing, dressing, and bathroom activities) while maintaining non–weight-bearing on the right lower extremity.

The social worker evaluated the patient's social support systems, discharge plans, and functional requirements for discharge, such as whether he would need to ascend and descend stairs in his home, or if he would need to cook for himself.

The initial rehabilitation team conference was held 4 days after the patient's referral to the Rehabilitation Medicine Service. The physical therapist reported that the patient had mastered his exercise program quickly and was able to execute the program independently. The patient was also independent in transfer skills, but had complained of pain in his left hand when attempting to bear weight on his left palm during transfers. This problem had been alleviated by the patient's bearing weight on his knuckles instead of his palm during transfers. The occupational therapist had provided the patient with a dressing stick, a long-handled shoehorn and an elastic shoelace for his right shoe, and he was now independent in dressing activities. He was also independent in bathroom activities and transfers, and had prepared a cold meal in the kitchen. He had been discharged from occupational therapy.

The physiatrist reported that the radiographs of the left hand had shown a nonunion of a scaphoid bone fracture. The Orthopedic Hand Surgery Services had been consulted about the hand injury and reported that no intervention was currently indicated. They also said that while weight-bearing on the hand would not be detrimental, it would be uncomfortable. This limitation would interfere with standard crutch ambulation. The social worker reported that the patient could return to his parents' home for convalescence, but that would necessitate his climbing a flight of stairs with a railing on the left-hand side (ascending) to reach the bathroom and his bedroom. Since his mother was a full-time homemaker, he would not be required to perform any homemaking tasks. The goal of independent ambulation, with the appropriate assistive devices (including stairs), was set in compliance with his weight-bearing limitations. This was to be accomplished by serial trials of axillary crutches or, if this was not tolerated, a Loftstrand crutch with a forearm support on the left and a standard Loftstrand crutch on the right.

At the next team conference, 1week later, the physical therapist reported that ambulation with axillary crutches had not been tolerated due to left-hand pain. Attempts at ambulation with a left forearm support crutch and a right Loftstrand crutch had been inadequate due to the patient's inability to swing his right leg through without putting weight on it. After consulting with the physiatrist, a 0.5-in. lift was placed on the left shoe by the orthotist. With the crutches and his shoe lift, the patient was then able to ambulate unlimited distances and ascend and descend stairs safely. The patient was discharged to his home for 5 weeks of convalescent leave.

Upon return from convalescent leave, a radiograph of the right femur showed satisfactory healing, and the cast was removed. The orthopedic surgeon cleared the patient for range-of-motion of the right knee, and weight bearing as tolerated on the right lower extremity. Initial physiatry evaluation noted active and passive right knee motion from full extension to 20° of flexion. There was approximately 1.5 inch of right calf and thigh atrophy compared to the left side. Right ankle range-of-motion showed normal plantar flexion but only 5° of dorsiflexion. Muscle strength of the ankle dorsiflexors, knee extensors and knee flexors was graded as 4/5.

The patient was referred to physical therapy for (*a*) active assisted range-of-motion of the right ankle and knee using moist heat and/or ultrasound to facilitate soft tissue extensibility; (*b*) progressive resistive exercise of the right quadriceps, hamstring, and ankle dorsiflexor muscle groups; and (*c*) progressive ambulation with weight bearing as tolerated. The social worker was consulted to act as liaison to the patient's military unit and to determine whether return to limited duty or further convalescent leave would be appropriate.

At the team conference 5 days after readmission, physical therapy reported that the patient had normal right ankle range-of-motion and ankle dorsiflexor strength. His knee range-of-motion had progressed to 80° of active flexion. Quadriceps strength remained decreased, but was improving. The shoe lift had been removed from the left shoe and the patient was ambulating for unlimited distances with his forearm support crutch on the left. The social worker reported that the patient's unit did not have an appropriate light-duty position for him, but that the patient would be temporarily reassigned and would be doing clerical work that required minimal ambulation. He could thereby live in the hospital barracks and attend physical therapy as an outpatient on a daily basis. The patient was discharged to the barracks and the order given for continued physical therapy.

The patient attended physical therapy daily as an outpatient and, under the direction and advice of his physi-

cal therapist, augmented this activity with resistive exercises in the base gymnasium and swimming pool. The physical therapist consulted with the physiatrist about the advisability of allowing the patient to resume a running program. After discussion with the orthopedic surgeon, the patient was cleared to resume running as tolerated. At the Rehabilitation Medicine Clinic followup 4 weeks after discharge, isokinetic testing showed the patient had full right knee range-of-motion, and normal and symmetric hamstring and quadriceps strength. He was ambulating without assistive devices and had begun running under the direction of his physical therapist. He was given a 3-month temporary physical profile restricting his running and marching activities initially, then allowing a gradual increase in these activities. He was returned to his unit.

The patient was seen for followup 3 months later at the time his profile was to expire. He reported he was able to run 5 miles at a pace sufficient to pass his physical training test, and could walk or march unlimited distances. He continued to have some discomfort in his left hand when doing pushups, but not to a significant degree. The patient was returned to duty without restrictions and discharged from the Rehabilitation Medicine Service.

Comment

In this example, multidisciplinary management (where healthcare professionals from different disciplines set discipline-specific goals without forming a comprehensive, coordinated plan) could have resulted in subtle, yet important, impairments being overlooked. For instance, if the nonunion of the scaphoid fracture had not been diagnosed and accommodated, the patient's mobility might have been severely limited, resulting in secondary deconditioning, which would have required more rehabilitation later. He also might have become a disposition problem if he could not ambulate with crutches and climb stairs. In addition, the therapists might have interpreted the patient's difficulty with crutch ambulation as malingering, thereby destroying the therapeutic relationship and further impeding recovery.

The communication between team members allowed them to consider the possibility of multiple secondary complications. Atrophy of the right leg musculature was limited by the early initiation of isometric exercises. Later, the potential complication of limited knee range-of-motion was avoided by close supervision of the rehabilitation process once the cast was removed. Finally, while he was preparing for return to full duty, which included physical training, the patient was protected from accusations of malingering by his physical profile. Without communication between the team members, this soldier could have become a medically discharged, permanently impaired, angry veteran.

Case Study 2: Above-Knee Amputation

A 19-year-old reservist was activated during the Persian Gulf War and sustained multiple fragment injuries during a missile attack. The most severe injury was to the left proximal leg, but other fragments involved the right distal thigh and sciatic nerve, the right distal arm and ulnar nerve, and the left brachial plexus. There was also a fragment in the area of the left ischial tuberosity. The patient was evacuated to a local hospital where the wounds were debrided. Vascular supply to the left foot and leg was severely compromised, but repair was attempted anyway. The patient was transferred to an army medical center for definitive care.

Evaluation at the medical center revealed that, due to inadequate vascular supply and extensive soft tissue loss, the left lower extremity was not salvageable. The wounds over the left ischial tuberosity, the right elbow, and right thigh were open, but healing by secondary intention. Neuromuscular examination was consistent with a distal lesion of the right sciatic nerve, a lesion of the right ulnar nerve at the elbow, and weakness of upper brachial plexus innervated muscles on the left. Rehabilitation Medicine Service was consulted for recommendations regarding the level of left lower extremity amputation, evaluation of peripheral nerve injuries by electrodiagnostic testing, and comprehensive rehabilitation management.

The physiatrist advised that preservation of maximal stump length should be the goal of amputation. Although a knee disarticulation stump presented certain problems with prosthetic fit and cosmesis, the extra length of the stump would provide some mechanical advantages over a shorter, above-knee amputation. Electrodiagnostic testing of the right lower and both upper extremities was interpreted as showing a partial right ulnar nerve lesion just above the elbow, a partial right sciatic nerve lesion in the distal thigh, and a probable neuropraxic lesion of the left upper brachial plexus. Left below-knee amputation was attempted, but the limb distal to the knee did not appear to be viable at the time of surgery, so a knee disarticulation was performed.

Postoperatively, the patient was transferred to the Rehabilitation Medicine Service and was ordered to occupational therapy for

- bilateral hand evaluations to include manual muscle testing along with sensory and dexterity evaluation;
- splinting of the right hand to prevent claw deformity and flattening of the palmar arch;
- facilitative techniques, such as electrical stimulation, to enhance recovery of right hand and left shoulder girdle musculature; and
- assessment of and training in ADL.

The patient was referred to physical therapy for

- evaluation and training in bed mobility and transfers;

- wheelchair adaptation to allow independent mobility;
- isometric and isotonic exercise of the hip and thigh musculature bilaterally;
- splinting of the right ankle to prevent plantar flexion contracture;
- active assisted range-of-motion and resistive exercises to all four extremities as tolerated; and
- facilitative techniques, such as electrical stimulation, to encourage activation of the distal right lower extremity muscles.

The physical therapist also taught the patient about amputation stump wrapping to reduce edema and sensitivity, and prone lying to prevent hip flexion contracture. The psychologist evaluated the patient and his family's response and adjustment to the injury, while the social worker evaluated the patient's support systems and his social and work history, and acted as liaison between the patient, his family, and the military administrative system.

At the initial team meeting 10 days following amputation, the physiatrist reported that the patient was medically stable and his amputation and other wounds were healing well. The occupational therapist reported that the patient had moderate deficits of strength and sensation in the ulnar distribution on the right, which required use of adaptive devices for writing, but which otherwise were not interfering with functional activities. The left shoulder girdle strength was improving. The patient was independent in self-care activities and transfers. It was noted that, while he cooperated and carried out all instructions and requests, the patient appeared to be withdrawn and angry, and resisted attempts of the therapist to involve him in conversation. The physical therapist reported that left hip range-of-motion was normal and hip extension and abduction strengths, while limited by postoperative pain, appeared to be improving. The patient still required assistance with stump wrapping and was reluctant to look at or touch his stump. He required frequent reminders to lie prone. Left ankle range-of-motion had normalized, and he had developed 2/5 ankle dorsiflexion and eversion strength, and 4/5 plantar flexion strength. The patient was independent in transfers and had been provided with a wheelchair with a right-hand rim with oblique projections to compensate for his hand weakness. He had been given a Roho cushion to minimize the pressure over the ischial wound on the left. He could propel the wheelchair independently for unlimited distances. The physical therapist also noted that the patient appeared withdrawn. The rehabilitation nursing staff reported that the patient was capable of being independent in self-care activities, but frequently requested that things be done for him. The nurses noted that the patient's family fostered his dependence and were demanding and critical of the nursing staff.

The social worker reported that the patient had been employed as a manual laborer prior to his injury and had joined the reserves to supplement his income. He had been living with his parents in a single-story home and was engaged to be married. Due to his military activation and the subsequent injury, the wedding had been postponed. Furthermore, the patient had an older brother who was a Vietnam veteran and a recovered substance abuser. The brother was receiving disability benefits for posttraumatic stress disorder. This same brother was active in veterans' groups and expressed a great deal of anger toward the military and veterans' healthcare systems because the diagnosis and treatment of his stress disorder had been delayed for several years. The psychologist confirmed that the patient was angry about disruption of his own life by his military duties, and that he had never truly considered the possibility of activation when he joined the reserves. He was reacting to his own anger and his brother's anger by dependence and withdrawal from socialization. He was not, however, exhibiting any vegetative signs or symptoms of depression.

On the basis of the information presented by the team members, goals were set for the next 10-day period, including ambulation with assistive devices and contact guard assistance, compliance with exercise programs, improved independence on the ward, completion of prevocational evaluation, and improvement in affect and socialization. Physical and occupational therapy programs were continued by beginning ambulation using a walker with a right forearm support and with a right molded-plastic ankle-foot orthosis. The psychologist worked with the patient individually and enrolled him in a support group for Persian Gulf War casualties. The physiatrist began collecting the necessary information for completion of the patient's medical evaluation board (MEB) and kept both the patient and his family informed on the status of these proceedings. The social worker continued to be liaison for the patient and his family, and attempted to make the family aware of some of the detrimental effects of the brother's anger and negativity, and of their fostering the patient's dependency. The nursing team, while understanding the patient's difficulty with adjustment, continued to encourage independence. The occupational therapist began prevocational assessment to define the patient's areas of interest and skills. The patient was referred to recreational therapy to explore avocational interests and improve socialization.

Ten days later, at the next team meeting, the rehabilitation nurse reported that the patient still tended to be withdrawn but was now independent in all self-care activities. The physical therapist reported that the patient's right ankle dorsi and plantar flexor strength now showed only minimal deficits, and that he was ambulating independently with axillary crutches but used the wheelchair for long distances. The surgical staples had been removed from the stump and it was well healed, conical, and nontender. He continued to have some phantom sensation, but no phantom pain. The occupational therapist reported that he had persistent, intrinsic muscle weakness in his right hand, but the left shoulder girdle strength was now normal. Prevocational assessment had revealed an interest in, and aptitude for, work with computers and information management. The psychologist reported that the patient was participating in individual and group therapy and, although there was still a good deal of re-

sidual anger, he was beginning to talk about and plan for his future in a realistic fashion. The social worker reported that his MEB had been completed and the physical evaluation board (PEB) was in process. His brother remained hostile but had agreed to refrain from criticizing his brother's care in front of the patient. The physiatrist reported that all the fragment wounds had healed, but the scar over the ischial tuberosity would be problematic for fitting with a standard quadrilateral socket above-knee prosthesis. At this point, it was decided to fit the patient with a temporary plastic quadrilateral socket with Silesian band suspension, safety knee, and single-axis foot.

Within 3 weeks the prosthesis was fabricated and the patient achieved independent ambulation using a single point cane. With ambulation the patient's stump began to shrink and daily adjustment of stump socks was required. Administratively, the patient had been discharged from the military with 50% service connected disability. It was felt by the physiatrist and prosthetist that the patient was not yet ready for a definitive prosthesis, but was ready for discharge from the hospital. The patient and his family wished to return home, which was several hundred miles from the military medical center. The physiatrist contacted the Rehabilitation Medicine Service at a Veterans Affairs Medical Center (VAMC) near the patient's home and transferred the patient's records and care to the VAMC.

The patient was seen by the VAMC Rehabilitation Medicine Service 1 week after discharge from the army medical center. An area of skin breakdown was noted over the ischial tuberosity on the right, and the patient continued to have right hand intrinsic muscle weakness in the distribution of the ulnar nerve. The ischial sore was treated with hydrogen peroxide rinses, rest periods with the prosthesis off during the day, and Duoderm dressing when wearing the prosthesis. The patient was continuing to add stump socks, currently wearing 15-ply, and was independent in ambulation without assistive devices. He was referred to the VAMC hand surgery clinic for follow-up of his ulnar nerve injury, and to the social work service for continued patient and family support. The vocational rehabilitation counselor continued testing and assistance with vocational training.

The patient was seen in VAMC Rehabilitation Medicine Services clinic at 2-week intervals and was discussed in outpatient team meetings. The social worker reported that the patient was proceeding with plans for his wedding. He was still reluctant to talk about his injuries, but he appeared to be adapting to his return to civilian life. The vocational counselor reported that he had narrowed his career choice to computer programming and was exploring training options. The physiatrist noted that the hand surgery clinic had requested repeat electrodiagnostic evaluation of the right ulnar nerve and that this testing had shown some improvement in nerve function, but had also shown significant residual axonal loss and denervation. The size of the knee disarticulation stump had stabilized and the patient was ready for permanent prosthetic fitting.

At 6 weeks following discharge from the army medical center, the patient was seen in conjunction with the prosthetist at the VAMC Rehabilitation Medicine Service clinic. It was noted that the scarred area over the right ischial tuberosity continued to be poorly pressure tolerant. It was decided to fit the patient with a narrow, medial lateral socket, which would eliminate weight bearing on the ischial tuberosity. The prosthesis was fabricated, and the patient was admitted to the VAMC rehabilitation unit for prosthetic adjustment and gait training. He quickly adjusted to the new prosthesis and was discharged after 10 days. He was followed in the VAMC rehabilitation medicine clinic at increasing intervals and continues to be seen annually, or on an as-needed basis for prosthetic evaluation.

Comment

In this case, early interdisciplinary intervention allowed for optimal surgical and rehabilitation planning. Not only was the rehabilitation team allowed to have input into the level of the amputation, but the patient also had the opportunity to be acquainted with the team from the very beginning of his hospital stay.

Once the surgery was over, careful attention to the patient's affect and social situation played a large part in determining an optimal outcome. Without recognition of confounding and conflicting family dynamics, the relationship between the nursing staff and the patient may have become nonproductive or even adversarial. Without close communication between the military rehabilitation physicians and the VAMC physicians, the patient may have been "lost to followup," or the confidence and trust established at the military hospital could have been destroyed by delay and redundancy.

Case Study 3: Traumatic Brain Injury

A 20-year-old soldier sustained facial fractures and closed head injury when his jeep overturned. At the scene he was pulseless and breathless. He was resuscitated and transported to the base hospital before air-evacuation to a civilian, Level I trauma center. On admission to the trauma center, the patient had a Glasgow Coma Scale rating of 4. A computed tomography (CT) scan of his head showed petechial white matter hemorrhages and diffuse swelling. The patient was taken to the operating room where an extraventricular drain was placed.

Postoperatively, the patient required hyperventilation, steroids, and draining of cerebral spinal fluid to control intracranial pressure. He was started on phenobarbital for seizure prevention, and required captopril for management of malignant hypertension. He remained in a coma for 20 days, during which time tracheostomy and gastrostomy feeding tubes were inserted, and he was weaned from the ventilator. Surgical repair of his facial fractures was attempted, but at induction of anesthesia, the patient had an episode of ventricular fibrillation, which necessitated an electrical defibrillation and lidocaine drip.

A myocardial infarction was diagnosed by cardiac enzyme and electrocardiographic changes. Approximately 3 weeks after the injury, the patient began spontaneously opening his eyes and responding to auditory and tactile stimuli. He was medically stable and arrangements were made for his transfer to a VAMC rehabilitation unit near his family's home.

On arrival at the VAMC, the patient was evaluated by a physiatrist who found that he was awake and alert, but did not verbalize or follow commands. He was mildly combative. He appeared to have upper and lower extremity weakness on the left side. He was diffusely hyperreflexic and had bilateral Babinski signs. Cranial nerves could not be evaluated due to the facial fractures and limited patient cooperation. Bilateral ankle dorsiflexion range-of-motion was mildly decreased. There were also 5° knee flexion contractures bilaterally, and a mild decrease in left shoulder range-of-motion. He had tracheostomy and gastrostomy tubes in place. His medications included phenobarbital, captopril, and haloperidol.

The plastic surgery department was consulted for management of the facial fractures; internal medicine for management of hypertension, arrhythmias, and postmyocardial infarction management; ear, nose, and throat surgery for tracheostomy management and possible decannulation; and neurosurgery for followup of head injury and seizure risk. The patient was referred to speech and language therapy for evaluation of swallowing, language perception, and potential for communication by nonverbal means. Psychology Services was consulted for cognitive evaluation and remediation. A social worker was consulted to determine the patient's planned disposition and to act as liaison between the military administration, the VAMC, and the family. The physical therapy department was consulted for active assisted range-of-motion to all extremities, resistive exercises as tolerated, bed mobility, sitting balance, transfers, and progressive ambulation as tolerated. The occupational therapist was consulted for upper extremity strength, sensation and dexterity evaluation, evaluation and training in ADL, cognitive and perceptual evaluation, and remediation. Orders were written for the nursing staff to begin bowel and bladder patterning programs to establish continence. The dietitian was consulted to evaluate nutritional status and recommend nutritional management.

At the initial team conference held 1 week after the patient's admission, the physiatrist reported that a plastic surgery evaluation of the facial fractures was underway and that a CT scan of the face had been scheduled. The nurse interjected that the patient would require sedation for this study. The physician from internal medicine recommended tapering off the captopril since the patient was normotensive, and hypertension had most likely been related to his acute head injury. There was no restriction placed on his activity level. Ear, nose, and throat surgery service had changed the tracheostomy tube to an uncuffed tube but did not recommend decannulation at this time due to continued large amounts of pulmonary secretions and the planned facial surgery. The neurosurgeon had recommended continued seizure prophylaxis for the next 11 months due to the presence of multiple hemorrhages.

The rehabilitation nursing staff reported that the patient did not follow commands, was combative, and required restraint to keep him from removing his feeding tube and tracheostomy. The haloperidol he received as needed for agitation was only partially effective. He was tolerating his tube feedings well. Bowel patterning had been successful, using every-other-day suppositories and digital stimulation, but bladder patterning was only partially successful; 50% of the time he voided when placed on the toilet; and he was incontinent approximately eight times a day. Postvoid residual volumes had been less than 50 cc^3. The dietitian reported that the patient was mildly anemic, protein deficient, and was 15 lb below his ideal weight. He was receiving both calorie and protein supplementation through his gastrostomy tube. The speech and language therapist reported that the patient had been uncooperative with both swallowing and language evaluation. At this time, barium swallow or oral feeding was not recommended. The physical therapist reported that the patient was combative and did not follow commands or demonstration. He neglected his left side. He had independent rolling in bed to the right, but not the left. He had poor sitting balance, falling to the left or backward. He tolerated range-of-motion poorly, but joint range-of-motion was being maintained. He had been fitted with foot-drop splints.

The occupational therapist also reported that the patient was combative and did not follow commands. He did some functional activities with his right upper extremity and had some left upper extremity movement in synergy patterns. Cognitive and perceptual evaluation could not be performed due to limited cooperation. He was dependent for all ADL. The social worker reported that the patient was an adopted child who had exhibited behavior problems as an adolescent. Both parents were employed full time and would not be able to care for him at home unless he was completely independent. The psychologist reported that the patient could not be evaluated due to low cognitive level.

After discussion, it was decided that medications might be blunting the patient's cognitive abilities. New treatment would include administering carbamazepine for seizure prophylaxis, and tapering off the phenobarbital. The haloperidol would be discontinued, and the patient would be started on amitriptyline in the evening with hydroxyzine hydrochloride (Vistaril) as needed for agitation. He would not be treated in the open physical or occupational therapy gymnasiums but in private treatment rooms where there would be minimal distraction. In an attempt to reduce the use of medication and restraints, the nursing service would provide one-on-one supervision when the patient was on the ward. Goals of increased attention span and mimicking of activities, increased awareness of the left side, fair sitting balance, 75% urinary continence, and decreased combativeness were set for the next 2 weeks. The physiatrist would order a urine culture to assess possible urinary tract infection that might be contributing to urinary incontinence.

At the next staffing conference 2 weeks later, some improvement in behavior had been manifested as less need for medications and restraint, but no progress had been made in the areas of continence, functional abilities, or cognitive function. The 3-dimensional CT scan had been obtained, and the plastic surgery team was planning a multistage reconstruction. However, the anesthesiologist would not clear the patient for elective surgery until he was at least 6 months postmyocardial infarction. The patient's family was angry and critical of his care and had not yet reconciled to the possibility that the patient might not recover completely. They were anxious for the facial surgery to be done so that the patient would "look normal." The team agreed to maintain the same goals and to review the patient's progress in 2 weeks.

No change or progress was reported at the next team conference. It was decided that the patient was not yet ready to participate in a comprehensive rehabilitation program. The social worker arranged for his placement in the skilled care facility of the VAMC, where he would continue to receive daily occupational and kinesitherapy, and be treated by a speech therapist 3 times a week. He was reviewed in the rehabilitation clinic at 2-week intervals, or whenever there appeared to be a change in his status. A family conference with the treatment team was held to explain the plan and answer any questions.

At the family conference, the reasons for transfer to the skilled nursing facility and plans for followup were presented to the patient's parents. They were angry and disappointed, but reluctantly accepted the decision. The social worker would continue to communicate with them regarding the ongoing involvement of the rehabilitation medicine service, and the physiatrist and rehabilitation nurse specialist would be available to talk with them. They were invited to accompany the patient to his rehabilitation medicine as well as to his other clinic followup appointments.

During the next 4 months, the patient slowly became less agitated and more cooperative. He began to follow commands and attempted communication. Speech therapy was increased to 5 days each week and a barium swallow was done. This showed aspiration of thick and thin liquids, but not solids. The speech therapist began working with him on swallowing as well as on communication. At the monthly interdisciplinary team conference, it was determined that the patient was ready for another trial of comprehensive rehabilitation, and plans for transfer back to the rehabilitation unit were made.

At readmission to the rehabilitation unit, the patient was awake and alert and followed simple, one-step commands. He could verbalize with his tracheostomy occluded, but speech was dysarthric, low volume, and confused. He also had significant motor and verbal perseveration.

He now had voluntary, isolated movement in the left lower extremity more than in the left upper extremity. Right upper and lower extremity strength was normal. Static sitting balance was good, bed mobility was independent, and transfers required minimal assistance by one person. Static standing balance was poor, primarily due to ataxia, and he ambulated only three to five steps with the assistance of two people. He was now continent of urine and on a voiding schedule every 4 hours, and was continent of bowel without suppositories. He was eating solids and taking thickened liquids, but only when under the direct supervision of the speech therapist. Body weight and serum chemistries were normal. Tracheostomy and gastrostomy tubes were still in place. He remained on carbamazepine and amitriptyline and had not required medication for agitation for the past 2 months.

The patient was referred to physical therapy for continued active range-of-motion, and progressive resistive and endurance exercise activities. The occupational therapist was consulted for perceptual and cognitive evaluation and remediation, upper extremity evaluation, and ADL evaluation and training. The speech therapist was consulted to continue work on swallowing and language and communication skills. A repeat barium swallow was also ordered. The psychologist was consulted for neuropsychiatric evaluation and testing. The social worker was to continue working with the family and patient on discharge plans, while the plastic surgeon was consulted for followup of plans for facial reconstruction.

The first team conference was held 10 days after readmission to the rehabilitation unit, and the physiatrist reported that the plastic surgeon wanted to schedule the first phase of the facial reconstruction within the next 4 weeks. The patient's parents were still very anxious for this surgery; however, the physiatrist was concerned that exposure to general anesthesia and the stress of surgery would compromise the cognitive recovery that was occurring. The family decided to go ahead with the surgery.

The physical therapist reported that the patient now had 4/5 strength throughout the left lower extremity, good dynamic sitting balance, standing balance with supervision, and verbal cues. He was able to transfer with supervision and verbal cues, and ambulate for 20 ft. with minimal to moderate assistance by two people. Upper and lower extremity joint range-of-motion was within normal limits. The patient still required constant cueing to perform his exercise program and exhibited little carryover of learning. The occupational therapists reported that there was no apparent left side neglect, but there was evidence of severe learning and memory deficits. The patient also exhibited components of motor apraxia in both upper extremities. He was capable of light hygiene activities, but required constant cues to complete tasks.

The speech therapist reported that a repeat barium swallow had shown minimal aspiration of thin liquids only and the patient had been placed on a mechanical soft diet with thickened liquids, which he was tolerating well. His speech showed components of both dysarthria and confused language, but no significant elements of aphasia had been identified. The rehabilitation nursing staff reported that the patient was continent during the day, but had occasional accidents at night. Although he at times became confused, he was not combative. He required constant reminders and cueing during functional activities and sometimes claimed he had not received his meals when he had eaten everything on the tray. The dietitian

reported that the patient was receiving adequate nutrition by mouth, and tube feedings had been discontinued. The psychologist reported that testing was very slow due to limited attention span and poor carryover of information. Severe deficits in ability to form new memories and in information processing had been uncovered. Reading comprehension was also limited, but this may have been preexistent to the brain injury.

The social worker reported that the patient's family would not care for him or take him home unless he was "normal." They expressed the opinion that it was the government's responsibility to care for him. They had, however, sought and received legal guardianship and were managing his financial affairs. The social worker had also determined that the patient was still on active duty military status. The military healthcare facility where he was first treated was requesting updated information for completion of the MEB.

New goals were set, including improved ADL with supervision and visual cues (pictures, simple lists), use of an activity logbook to aid memory, independence in the exercise program with visual cues, ambulation with contact guard assistance of one or two people and nighttime continence. The physiatrist would confirm the surgery date and prepare a summary for the patient's military physician. It was also decided to start tapering the amitriptyline since agitation was no longer a problem. The social worker would investigate alternatives to his discharge home.

The first phase of the patient's facial reconstruction was scheduled for 3 weeks later. Two weeks after the initial team conference, the physical therapist reported that the patient was ambulating with contact guard assistance of one person due to occasional loss of balance. He could also ascend and descend a flight of stairs with one railing and contact guard assistance. He continued to require verbal cues to complete his exercise program, but was improving. The occupational therapist reported the patient could complete simple hygiene tasks with setup and occasional cues. He required maximal assistance to make entries in his activities logbook and did not spontaneously use the book to assist his memory. He was working on dexterity activities and showing steady improvement. The speech and language department reported that verbal output was more comprehensible and appropriate, and that he had no dietary restrictions at present. The psychologist reported that his memory and learning skills remained poor, but his ability to comprehend written information was slowly improving. The social worker reported that the patient's family was more content now that the facial surgery was scheduled and the patient was showing some improvement. However, they were becoming less available, that is, visiting only once or twice a week for short periods and not promptly returning phone calls. The physiatrist reported that the patient would be transferred to plastic surgery service preoperatively and would remain there postoperatively until he was medically stable.

The patient underwent facial surgery. Postoperatively, he required heavy sedation to control pain. Rehabilitation medicine consultation service followed the patient on the surgical ward and recommended restarting tube feeding to preserve nutritional status. They also recommended that when the patient was alert, he should resume physical, occupational, and speech therapy as tolerated. Unfortunately, the patient's postoperative course was complicated by fever and diffuse infection of the frontal bone flap. The patient required aggressive fever management and removal of the frontal bone flap. Treatment with intravenous antibiotics was recommended for at least 6 weeks. After 1 week of antibiotic therapy, the patient was able to resume rehabilitation therapies on a limited basis. At 3 weeks postoperatively, he was participating in a full rehabilitation program and returned to the rehabilitation medicine unit with a Hickman catheter in place. Due to the infection, no further facial reconstruction was planned for at least 6 months.

The patient continued physical therapy, occupational therapy, speech therapy, and meeting with the psychologist. Every other week, goals were set at the team conference. Six weeks after his return to the rehabilitation unit, the patient was independent in ambulating, performing a resistive exercise program, and in ADL. However, his memory and ability to use assistive devices, such as the activities logbook, remained poor. Due to the memory deficits and inability to learn new information, it was determined that the patient would require a closely supervised living situation. The social worker had learned that he had been placed on the Temporary Disabled Retirement List by the military, making him ineligible for VA vocational services. His family was still unable to care for him at home. Placement in a VA domiciliary care facility was initiated, and the patient was transferred to the domiciliary care facility 2 weeks later.

Followup in the Rehabilitation Medicine Service clinic continued at 3-month intervals. The patient's memory and cognitive deficits showed minor improvements as he acclimatized to his surroundings. He received a medical discharge from the military with 100% disability, and it was recommended that he be referred to VA vocational rehabilitation for evaluation for independent living support services and possibly sheltered employment. The patient's family, however, refused this until facial reconstruction was complete. Since his parents were his legal guardians, no further action could be taken. After 1 year, he was discharged from the rehabilitation medicine clinic. He continues to undergo staged reconstruction of his face and resides in the domiciliary care facility.

Comment

Traumatic brain injury without other complicating injuries is rare, and the care of these multiple-injured patients requires the coordination of many medical and surgical specialists. To avoid conflicting medical and surgical treatment plans, it is essential that one physician review all the recommendations, resolve conflicts, and assure that all issues are addressed. A physiatrist is uniquely suited to this role.

In addition, traumatic brain injury has effects that reach far beyond the injured individual to his family, friends, and community. Unfortunately, return to an independent lifestyle is not always possible, and alternative, appropriate living arrangements must be made. A major role of the rehabilitation team is to assist the family in recognizing the deficits that will prevent return to a "normal" life and to set appropriate goals and make plans. Family members often have difficulty accepting the changes in personality and behavior that result from traumatic brain injury. Unless the interdisciplinary team members have communicated effectively among themselves and arrived at a consensus plan and goals, conflicting information and attitudes may reinforce the family's denial, impairing the ability to move forward with disposition planning.

Close followup after the patient's transfer to a skilled care facility allows for prevention of secondary complications, such as joint flexion contractures and skin breakdown, as well as the recognition of spontaneous recovery and the appropriateness of different levels of rehabilitation services.

Case Study 4: Spinal Cord Injury

A 20-year-old soldier sustained a thoracic vertebrae fracture/dislocation at T-9 and T-10 in a two-car, head-on collision. At the scene, the patient reported his legs were numb and he could not move them. He was placed on a back board and transported to a local hospital. Initial evaluation revealed stable vital signs, normal level of consciousness and normal upper extremity strength, but no sensation below the level of umbilicus, and no volitional movement of the lower extremities or lower quadrant abdominal muscles. Radiographs of the cervical spine showed no fracture or instability. Thoracolumbar spine radiographs showed complete anterior dislocation of T-9 on T-10. Foley catheterization of the bladder yielded 1,000 mL of clear urine. A CT scan of the fracture area showed multiple fragments and complete disruption of the spinal canal and its contents. The patient was placed on a Stryker frame and admitted to orthopedic surgery service.

Ten days elapsed before his transfer to a VA Spinal Cord Injury Center could be arranged. On arrival at the spinal cord injury center, the patient was found to have motor and sensory complete T-10 paraplegia. A Foley catheter was in place and drained cloudy, foul smelling urine. Rectal examination was consistent with fecal impaction. A grade I decubitus ulcer had formed over the sacral area and large blisters over both heels. Joint range-of-motion at the hips showed mild limitations of internal rotation, and ankles dorsiflexed only to neutral. Tone was returning to the lower extremities and the patient reported occasional spasms. He was placed in a Gutmann bed with orders for position change from side to side every 2 hours and no supine positioning. Urine was sent for analysis and culture. The Foley catheter was removed and an every 6-hour intermittent catheterization regimen begun. Digital disimpaction and enemas were ordered; a bowel program consisting of high fiber diet, stool softener, and every-other-day suppositories was initiated.

Deep vein thrombosis prophylaxis was ordered consisting of 5,000 units of subcutaneous heparin 3 times a day. Orthopedic spine surgery service was consulted for management of the thoracic fracture/dislocation. The patient was referred to physical therapy for resistive exercise of the upper extremities and passive range-of-motion of the hips, knees, and ankles at bedside. The occupational therapist was consulted for foot-drop splints and assistive devices for ADL. The psychologist was consulted to provide emotional support and counseling. The social worker began investigation of the patient's social situation and resources, and acted as liaison among the patient, the family, and the military administration. The recreational therapy department was asked to explore the patient's avocational interests and activities.

At the team conference 1 week after admission, the physiatrist reported that the patient's fracture was judged stable and he had been cleared to get out of bed. An abdominal binder was used to provide increased ventilation, secretion clearance, and trunk support. Urine culture was positive for infection, and the patient was being treated with oral antibiotics. The rehabilitation nursing staff reported that the patient was cooperative and pleasant. His bowel program was effective and bladder volumes were under 400 mL. There had been no spontaneous voiding. The sacral area was completely healed. The blisters over the heels had been unroofed and there was healthy granulation tissue at the bases. The patient was tolerating the Gutmann bed well.

The physical therapist reported that the patient was maintaining normal upper extremity strength through Theraband and free weight exercises. He was independent in his exercise program. His lower extremity range-of-motion at the hips, knees, and ankles was now normal. Tone in the lower extremities was increasing bilaterally with several beats of unsustained clonus at the ankles. Frequency of spasms was increasing, but these were not currently interfering with function. The occupational therapist reported that evaluation of the patient's ADL abilities had been limited by the patient having to remain flat in bed. There were no deficits in dexterity identified at this time, and occupational therapy was on hold until the patient could be mobilized. The psychologist reported that the patient's spirits were good, but there appeared to be a significant degree of denial regarding his injury and potential recovery. The social worker reported that the patient was single and had been living in the barracks. He had been raised in a single parent home and that parent currently could not be located. He had a GED (General Education Diploma) and had been an airborne ranger. At the time of the injury, he had been training for a triathlon. The recreational therapist reported that all the patient's avocational interests had centered around sports, both as participant and spectator. At present, he seemed to be content to watch television and wait until he "got

better." The team concurred that the patient was obviously in a phase of denial and, given his past emphasis on physical activities, adjustment to his impairments would be difficult. All team members would gently but firmly reinforce that recovery of lower extremity function was unlikely while stressing the patient's residual ability and potential for participation in adapted activities and sports.

The treatment plan was to transfer the patient into a regular hospital bed and to begin working with him to become more mobile. An abdominal binder was ordered. Goals for the next 2 weeks were set at independent bed mobility, tolerance of sitting for 2 hours at a time, fitting of an appropriate wheelchair, independence in upper body hygiene, feeding and grooming activities, continued control of bowel and bladder, and healing of the heel ulcers.

Two weeks later the rehabilitation nurse reported that the patient had several episodes of spontaneous voiding. Postvoid residual urine volume was 200-300 mL. The ulcers over the heels were nearly healed. He had, however, developed a right, grade I ischial ulcer after sitting in his wheelchair for 2.5 hours one day. His wheelchair cushion was changed, and the nursing staff reinforced the need for pressure releases every 5 to 10 minutes. The physical therapist reported that the patient was independent in bed mobility. He had had no problem tolerating the upright position and was able to maintain sitting on the edge of the exercise mat with upper extremity support. He required the moderate assistance of one person to go from supine to sitting and the moderate assistance of two people for sliding board transfers. He could propel his wheelchair for unlimited distances. Joint range-of-motion was being maintained throughout the lower extremities, and the patient required only occasional assistance and cueing with his range-of-motion program.

The occupational therapist reported that the patient was independent in feeding, upper body hygiene, and dressing with set up. He required minimal assistance and adaptive devices for lower extremity dressing. The psychologist reported that his spirits remained good, though there was still concern about denial. Socialization with the other patients on the unit was being encouraged, and the recreational therapist reported that the patient was working on craft activities in a group setting. He had not yet participated in any outings. The social worker reported that the patient's MEB had not yet been done and the army was requesting an updated medical summary.

It was agreed that during the next 2 weeks the physiatrist would perform urodynamic studies of the patient's bladder and change his bladder program if needed. The physiatrist would also provide the military with an updated medical summary. The physical therapist's goal would be sliding board transfers with minimal assistance and independent supine to sit transfers using an overhead trapeze. Need for pressure release when sitting would be stressed. The occupational therapist would begin working on bathroom transfers and activities. The psychologist would continue to provide support while the recreational therapy department would include the patient in the next outing.

At the next team conference 2 weeks later, the physiatrist reported that urodynamic testing had shown a spastic bladder with a significant degree of dyssynergia and vesicoureteral reflux. The intermittent catheterization program would be continued. The nursing staff reported that the patient had been compliant with his skin care regimen and there were no new skin problems. The physical therapist reported that spasticity was becoming more of a problem, and spasms were interfering with transfer. At this point the patient could transfer with the minimal assistance of one person, but as a safety precaution, a second person needed to be available. It was also noted that left hip range-of-motion, especially rotation, had become limited. The occupational therapist concurred that spasticity was interfering with bathroom transfers. The recreational therapist reported that the patient had gone out to the movies, but that he had appeared somewhat self-conscious and frustrated at his dependence. The psychologist reported that the patient was less cheerful but had not yet started talking about his injury and disabilities. The nursing staff added that a few of his friends from high school had come to visit over the weekend and, although he had enjoyed the visit, he was withdrawn afterwards.

The possibility of heterotopic ossification at the left hip was discussed. The physiatrist would order plain radiographs and, if these were normal, a bone scan would be done. Urinary tract infection was also considered as an etiology of increased spasticity and a urine culture was ordered. The physical therapist would continue to work on transfer skills and would monitor more closely the patient's range-of-motion program. The occupational therapist would continue the current treatment plan, but would begin some prevocational testing and discussions with the patient. The recreational therapist would continue to include the patient in activities and try to arrange for him to attend a wheelchair basketball game. The psychologist would continue to provide support and counseling.

Radiographs of the left hip were normal, but bone scan showed abnormality at the left hip consistent with heterotopic bone formation. The patient was started on etidronate disodium (Didronel). Urine culture was positive for infection and an appropriate antibiotic regimen was begun. Within a few days of treatment initiation, spasticity was less marked and not interfering with activity. At the next team conference, the physical therapist reported that the patient required supervision only with occasional contact guard assistance for all transfers. Left hip range-of-motion was still decreased, but improving. The occupational therapist reported that the patient was independent in self-care activities but had been resistant to prevocational assessment and discussion. The recreational therapist reported that the patient had attended one basketball game, but declined to attend a second. While at the game, he had been critical of the activity. The psychologist reported that the patient was beginning to recognize the permanence of his impairments and the changes to his lifestyle, and the rehabilitation nursing staff reported that the patient had begun talking to one of the young, male, night nursing aides about his disability. The social worker reported that neither the patient's MEB nor PEB had been completed.

The plan for the next 2 weeks was to continue working on functional and self-care abilities. The occupational therapist would continue with the prevocational evaluation, and the patient would also be referred for handicapped driver-training assessment. Because of special regulations for spinal cord injured service members, this patient was eligible for VA vocational rehabilitation counseling services before his discharge from the military.

During the next 3 months the patient continued to progress in all areas of independent functioning. He went through a period of depression and anger about his injury and impairments but, with the support of the team and other patients, was able to come through this and begin planning his future. This included counseling regarding sexual function and fertility. With the aide of a social worker he was able to find an apartment near his old neighborhood and to purchase a car. He decided to pursue training as a photographer and would begin classes in the fall. After 4 months in the rehabilitation unit he was discharged to live independently. He continued to receive his healthcare at the VA spinal cord center as an outpatient.

Comment

As a patient moves through a rehabilitation program, his needs change. In response to these changing needs, the composition of the interdisciplinary team must change. In the case of a spinal cord injured patient, the initial area of concentration is on physical abilities and medical management, but as the patient learns new skills, the emphasis shifts to social and vocational issues.

Case Study 5: Cervical Strain

A 37-year-old supply sergeant experienced neck pain and stiffness after a box of boots fell from the top of a stack and struck him on the side of his head. There was no loss of consciousness. He was initially seen in the troop medical clinic by the general medical officer (GMO) and complained of occasional electric shock-like pain radiating down his right arm and paresthesias in the thumb and index finger when lying supine or turning his head to the right. A nonsteroidal antiinflammatory drug (NSAID), a soft cervical collar, and physical therapy were ordered.

A physical therapist's evaluation of the patient revealed paraspinal muscle spasm with decreased neck rotation and lateral flexion. The right brachioradialis muscle stretch reflex was decreased compared to the left and there was mild weakness of the wrist extensors, forearm pronation and elbow flexion on the right. The physical therapist contacted the GMO to discuss the neurologic findings and proposed treatment plan.

After discussion, cervical spine radiographs were ordered to include flexion/extension views. These showed no fracture or instability. A treatment program including cervical traction, superficial heat, NSAID, active cervical and shoulder range-of-motion, and a Philadelphia collar was developed. Reevaluation of the patient's neurological status was done daily by the physical therapist.

After 2 weeks, the patient reported a 75% decrease in neck pain, occasional radicular pain, and resolution of the paresthesias. Neck range-of-motion was still limited, and cervical paraspinal spasm was still evident but decreased. Strength in the right upper extremity was stable as were muscle stretch reflexes. The GMO confirmed the therapist's findings and the treatment regimen was continued.

After 4 weeks of treatment, the patient reported complete resolution of the radicular pain and about a 90% decrease in neck pain. Muscle stretch reflexes were now symmetric, but the right arm remained slightly weak. Cervical spine range-of-motion was now normal and spasm was resolved. After discussion, cervical traction was discontinued and neck range-of-motion against gentle resistance was begun. Progressive resistive exercises for the right upper extremity were also begun. The GMO provided the patient with a temporary profile excusing him from running, lifting more than 10 lb, overhead work, and pushups for the next 2 months; however, the patient was instructed to use the stationary bicycles and stair climbers in the base gymnasium to maintain aerobic conditioning. Over the next month the patient continued to be seen in physical therapy at increasing intervals. His upper extremity strengthening program was transferred to the base gymnasium, and he was instructed to gradually resume other activities. Two months after his initial injury he was discharged from physical therapy and returned to full duty.

Comment

This last case illustrates that interdisciplinary management does not take place only in the physiatry clinic, but can be accomplished at the troop medical clinic level. The interdisciplinary management of this case differed from the more common multidisciplinary management because of the communication between the physician and the therapist, and the formation of an integrated treatment plan, including pharmacologic intervention, restriction of activity, and exercise and physical modalities. Without effective communication between the therapist and physician, inappropriate treatment may have led to further or prolonged impairment. Also important is the attention to the patient's overall health and fitness. If the patient had simply been given a profile but not instructed in alternative ways to maintain his aerobic conditioning, he would have required further rehabilitation once his return to normal activity was allowed. Even worse, he may have suffered secondary injury due to deconditioning when he returned to full activity.

In summation, the five previous cases highlight the importance of involvement of the patient as well

as any other involved family members or caregivers in the rehabilitation process. It has been pointed out that the patient is the only one who is intricately involved in all phases of the rehabilitation program. Furthermore, as the patient moves through the rehabilitation process, team members may change, but the foundation of interdisciplinary management and communication remains the same.

CONCLUSION

The rehabilitation of transient or permanent physical impairment requires the cooperation and work of a wide variety of individual healthcare practitioners. Whether the impairment is relatively simple and temporary (such as the case of a distal femoral fracture, Case Study 1), or complex and permanent (in the case of severe traumatic brain injury, Case Study 3), management by an interdisciplinary team will clarify goals, coordinate treatment plans, reduce the redundancy of efforts, and lessen or help to avoid the impact of secondary complications.

REFERENCES

1. DeLisa JA, Martin GM, Currie DM. Rehabilitation medicine: Past, present, and future. In: Delisa JA, ed. *Rehabilitation Medicine: Principles and Practice.* Philadelphia, Pa: JB Lippincott; 1988: 3-24.

2. Ruskin AP. Evolving roles of health professionals in care of the disabled. In: Ruskin AP, ed. *Current Therapy in Physiatry, Physical Medicine and Rehabilitation.* Philadelphia, Pa: WB Saunders; 1984: 569-574.

3. Keith RA. The comprehensive treatment team in rehabilitation. *Am J Phys Med Rehabil.* 1991;72(5):269.

4. American Medical Association. *Directory of Graduate Medical Education Programs.* Chicago, Ill: American Medical Association; 1991-1992:102-105.

5. LeFebvre C, Berryman D. Therapeutic recreation. In: Goodgold J, ed. *Rehabilitation Medicine.* St. Louis, Mo: CV Mosby; 1988: 916-923.

6. Stryker R. An overview of rehabilitation nursing. In: Stryker R. *Rehabilitative Aspects of Acute and Chronic Nursing Care*. Philadelphia, Pa: WB Saunders; 1977: 17-25.

7. Dvonch P. Vocational rehabilitation counseling services. In: Goodgold J, ed. *Rehabilitation Medicine.* St. Louis, Mo: CV Mosby; 1988: 908-915.